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A Freshwater Sponge-Mollusk Association in Amazonian Waters

by

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I. Introduction

The only metazoans long known to occur in association with freshwater sponges are other freshwater sponges (JEWELL 1935; VOLKMER-RIBEIRO and DE ROSA-BARBOSA 1972), and insect larvae of the Sisyridae (Neuroptera) (BROWN 1952; PARFIN and GURNEY 1956). ROBACK (1968) reports also the association of larvae of the Leptoceridae (Trichoptera) and of the Chironomidae (Diptera) with freshwater sponges. Mollusks, though accidentally found among the many metazoans which use freshwater sponges as substratum (OLD 1932a; BONETTO and DE DRAGO 1966), have never been reported to live or reproduce inside one of them.

Large communities of freshwater sponges are very characteristic of certain Amazonian waters. When the authors started the study (1972) of a large collection of freshwater sponges picked from two such communities at middle river Juruá, their attention was attracted to the presence of sometimes large numbers of shells of a small pelecypod adhering to the surface or interior of some of the dried sponges. Dr. M.A. Klappenbach of the Museu Nacional de Historia Natural de Montevideo, to whom the mollusks were sent for study has classed them within the genus *Eupera* of the Sphaeriidae.

The present paper lists those species of freshwater sponges which were found to bear specimens of the pelecypod, and describes briefly the degree of association in each case.

In view of the occurrence of *Drulia batesii* (BOWERBANK 1863) and of *Drulia brownii* (BOWERBANK 1863) among the presently listed freshwater sponges, a brief comparative study of these two species is also offered. This increases the number of distinctive characteristics known for both species.

Acknowledgments

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II. Species of freshwater sponges (Porifera-Spongillidae) bearing *Eupera* sp. in association

Genus *Drulia* GRAY, 1867 (as redefined by PENNEY and RACEK, 1968).

Drulia batesii (BOWERBANK, 1863)

Material: Conceição do Raimundo at middle river Juruá, Brazil. J.C. de Melo Carvalho, 25 June 1950 (MRCN Catalog no. 95).

Drulia brownii (BOWERBANK, 1863)

Material: Conceição do Raimundo at middle river Juruá, Brazil. J.C. de Melo Carvalho, 25 June 1950 (MRCN Catalog no. 210 and 197.)

Taxonomic remarks:

Specimens no. 95 (*D. batesii*) and no. 210 (*D. brownii*) are associated, their hispid projections deeply penetrating each other at the contacting points. The two associated adult specimens thus offered an excellent opportunity for a comparative study of these two species. *D. batesii* is in fact "clearly distinct from *D. brownii*" (PENNEY and RACEK 1968, p. 160) not only at microscopical level, as noted by those authors, but also to the naked eye. Dried material of *D. batesii* has a brown color, the gemmules are not as abundant as in *D. brownii* and are enclosed in almost inconspicuous, brownish, corrugated capsules; the distinction between radial and transverse fibers is not very conspicuous, the skeleton is a strong network of regular meshes. The presence of a large amount of microscleres in the outer gemmular membrane of gemmules of *D. batesii* allows also a fast microscopic distinction between the two species. Dried material of *D. brownii* is usually of gray color, has extremely abundant gemmules enclosed in conspicuous whitish capsules; poorly developed transverse fibers lead to a radial distribution of slender fibers arranged to form a delicate network of very open meshes. Very characteristic for *D. brownii* are the large funnel-like oscular apertures which go from the surface straight to the central portion of the sponge.

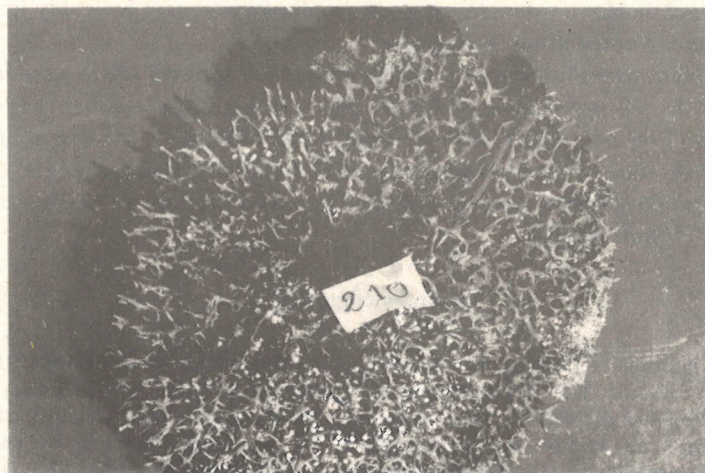


Fig. 1. Specimens MRCN no. 210 (*D. brownii*) and MRCN no. 95 (*D. batesii*). *D. brownii* with its abundant, larger, conspicuous whitish gemmules has here grown on *D. batesii*. Also distinctive for *D. brownii* are its terminally bifurcated radial slender fibers (upper left). The compact network of regular meshes of *D. batesii* can be seen at middle right. Specimens of *Eupera* sp. are not seen due to deep penetration in the sponge networks.

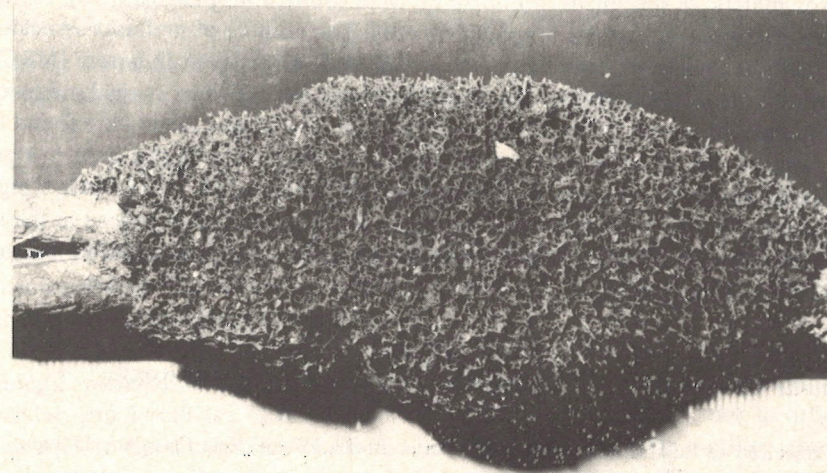


Fig. 2. Specimen MRCN no. 97 (*Metania* sp.). A close scrutiny will show the many specimens of *Eupera* which lived in this sponge.

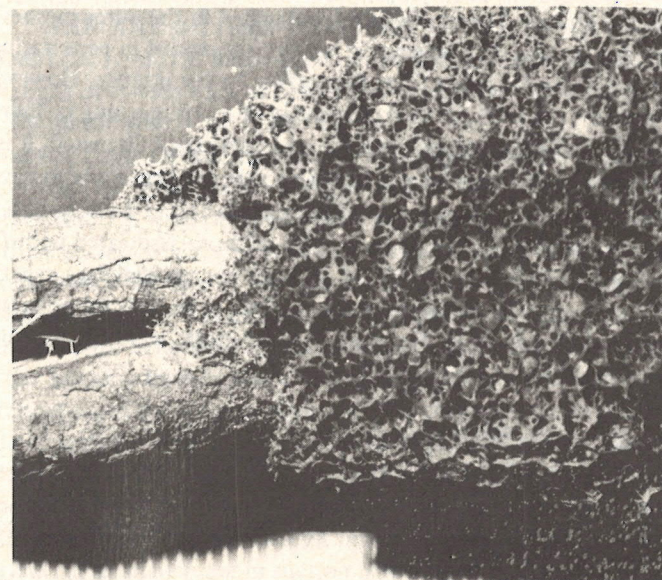


Fig. 3. Part of photomicrograph no. 2 was enlarged to show different levels of penetration by the mollusk, as well as almost complete occupation of the sponge reticulum by a whole "population" of the bivalve.

Remarks on the mollusk-sponge association:

Approximately 28 specimens of *Eupera* sp. were counted in sponge no. 95, 6 specimens in sponge no. 210 and 9 specimens in sponge no. 197. The number of mollusks associated with *D. batesii* was thus larger than that associated with *D. brownii*. In *D. batesii* (MRCN no. 95) the mollusks are found in the very core of the sponge, entangled in its rigid meshwork and with no apparent chance of returning to the surface. The largest shells were found here amongst a range of very varied sizes, from minute to very large. Also in this sponge, a group of minute shells was seen very close to what must be an "adult" shell, clearly indicating a parental relationship. The preference of the mollusk for *D. batesii*, as evidenced in the two associated specimens of *Drulia*, is probably because the meshwork of this species is stronger and has smaller, regular meshes.

Genus *Metania* GRAY, 1867 (as redefined by PENNEY and RACEK, 1968).

Metania sp.

Material: Conceição do Raimundo at middle river Juruá, Brazil, J.C. de Melo Carvalho, 25 June 1950 (MRCN Catalog no. 97).

Taxonomic remarks:

The specimen is part of a large collection of sponges of this genus, collected from Amazonian waters and subject of a revisional study under completion by the senior author.

Remarks on the mollusk-sponge association:

Approximately 138 specimens of *Eupera* sp. were counted in this sponge, the exact number certainly being greater. The mollusks are entangled in the outer meshes of the rigid silicious skeleton of the sponge. The pelecypod has not succeeded in penetrating this sponge deeply because the mesh size decreases from the surface to the interior. However, whenever a larger mesh was present, the mollusk took advantage of it for reaching farther inside the sponge. When comparing this association with the one previously discussed, it is seen that in the *Metania-Eupera* instance the smaller size of the sponge meshes seems to have worked as a selective factor for shell size of the whole mollusk population in the association. Shell sizes here are uniformly considerably smaller than the size of those associated with *D. batesii* and *D. brownii*. (PARODIZ and HENNINGS (1965) consider microisolated aggregations of the Superfamily Sphaeriacea, such as the ones described here, as an isolated population or micro-deme). Again, specimens of *Eupera* sp. from minute to "adult" were found inside the sponge.

Genus *Trochospongilla* VEJDOWSKY, 1883

Trochospongilla paulula (BOWERBANK, 1863).

Material: Conceição do Raimundo at middle River Juruá, Brazil, J.C. de Melo Carvalho, 25 June 1950 (MRCN Catalog no. 89); Eirunepé at middle River Juruá, Brazil, J.C. de Melo Carvalho, 18 June 1950 (MRCN Catalog nos. 102, 111 and 208).

Remarks on the mollusk-sponge association:

2 specimens of *Eupera* sp. were counted on sponge no. 89; 3 specimens on sponge no. 102, 2 specimens on sponge no. 111 and 1 specimen on sponge no. 208. These are young specimens of *T. paulula* in which the skeleton has not yet reached full development. The few mollusks counted obtained support against the basal membrane and the hispid projections of the sponge.

Trochospongilla delicata BONETTO and DE DRAGO, 1967 (part)

Material: Eirunepé at middle River Juruá, Brazil, J.C. de Melo Carvalho, 18 June 1950 (MRCN Catalog no. 109).

Remarks on the mollusk-sponge association:

There was only one large specimen of *Eupera* sp. on this sponge.

III. Discussion

KLAPPENBACH (1967) in his revision of the *Eupera* species described for South America, emphasises the scarcity of references registered for the large Amazon basin, and describes *E. primei* from Peruvian waters.

Little is known of the biology of the genus *Eupera*. DOELLO-JURADO (1920) when describing *E. platensis*, states that the species is viviparous like all other members of the Sphaeriidae, and describes a byssal filament by which adult specimens stick to other little shells or aquatic vegetation. The foot is also described as having little motility, thus indicating together with the presence of a byssus, sedentary living conditions. The reproductive process, which seems to have a lot of bearing on population structure within the Superfamily Sphaeriacea, has however been given a good deal of attention by several authors (GILMORE 1917; FOSTER 1932; THOMAS 1959). "Since the young are born alive, and are neither dispersed as eggs nor larval forms carried by hosts, all young from one parent begin sedentary life at the same place or within a very small surrounding area. The reproduction, habits, and limited dispersion of the individuals during their lifetimes result in the formation of small breeding aggregations...." (PARODIZ and HENNINGS 1965, p. 70).

HERRINGTON (1962) in his revision of the Sphaeriidae of North America reports marked adaptations of species such as *Sphaerium occidentale* and *Pisidium casertanum* to habitats that dry up for several months of the year.

Individuals of *Eupera* would thus be theoretically expected, as members of the Sphaeriacea, to take advantage of the living conditions inside the sponges. The sponges, as completely sedentary animals, were obviously used merely as a substratum by the mollusk in the first stage of the association. Since it is known that all bivalves are common prey for fishes, it is understandable that the role of sponges changed next from substratum to that of sheltered refuge, offering the mollusk conditions for population expansion. Self-fertilization, which is common sexual behaviour for this mollusk, together with its limited dispersion after birth and the fact that there is almost unlimited substratum available inside the multi-dimensional reticulum of the sponges such as *D. batesii* and *Metania* sp., would be expected to lead to the occupation of the interior of the sponge by large numbers of the mollusk, such as has been described in this paper. Also worthy of consideration is the fact that both the sponge and the bivalve are filtrator organisms with respect to food intake. The large number of individuals of *Eupera* found inside *D. batesii* and *Metania* sp. cannot be disregarded as a factor contributing to an increase in suction potential in the system. Such an increase in the rate of food intake would very probably benefit both the sponge and the mollusk.

Habitat conditions under which the association described here takes place are briefly reviewed in a recent paper by the authors (1972). Sponges from this area are subjected to annual, regular, quite long periods of drought when water level falls to a minimum, leaving most, if not all, of the sponges out of the water for several months. Unfortunately the collecting

data do not contain information as to whether the sponges listed in this report were picked from a level where they would be perennially submersed in the water or not. Before starting speculations as to the probability of the mollusk having withstood the drought period alive inside the sponge, it would be worthwhile considering the probability that the whole *Eupera* population developed during one submersion period.

IV. Summary

The association of *Eupera* sp. (Sphaeriidae-Pelecypoda) with several species of freshwater sponges is reported for River Juruá, Brazil, this being the first report of association of a mollusk with freshwater sponges.

V. Resumo

Relata-se, no presente trabalho, a associação de um molusco, *Eupera* sp. (Sphaeriidae-Pelecypoda) com diversas espécies de espongiídeos do rio Juruá, sendo este o primeiro registro, de que temos conhecimento, para tal associação.

VI. References

- BONETTO, A.A. and I. EZCURRA de DRAGO (1966): Notas Malacológicas IV. 1) Moluscos Paranaenses en aguas Uruguayas y del sur de Brasil. 2) Notas sobre desoves de algunos Gasteropodos dulceacuicolas.— *Physis* 26 (71):121–127
- BROWN, H.P. (1952): The life history of *Climacea areolaris* (HAGEN), a neuropterous “parasite” of freshwater sponges.— *Amer. Midl. Nat.* 47:130–160
- DOELLO-JURADO, M. (1921): Una nueva especie de “*Eupera*” del rio de la Plata.— *Physis* 5:72–75 1 Fig.
- FOSTER, T.D. (1932): Observations on the life history of a fingernail shell of the genus *Sphaerium*.— *Jour. Morph.* 53 (3):473–497
- GILMORE, R.J. (1917): Notes on reproduction and growth in certain viviparous mussels of the family Sphaeriidae.— *Nautilus* 31:16–30
- HERRINGTON, H.B. (1962): A revision of the Sphaeriidae of North America (Mollusca: Pelecypoda).— *Misc. Publs. Mus. Zool. Univ. Mich.* 118:1–74, 7 est.
- JEWELL, M.S. (1935): An ecological study of the freshwater sponges of northern Wisconsin.— *Ecol. Monogr.* 5:463–501
- KLAPPENBACH, M.A. (1967): “*Eupera primei*” sp. n. de la region del rio Ucayali, Peru (Mollusca, Pelecypoda).— *Simpósio Sobre a Biota Amazonica, Belém, June 6–11, 1966.*— *Atas do Simposio Sobre a Biota Amazônica, vol. 3; Limnologia, Rio de Janeiro, Cons. Nac. de Pesq., 1967,* 225 p: 109–115
- OLD, M.C. (1932a): Contribution to the biology of freshwater sponges (Spongillidae).— *Papers Mich. Acad. Sci. Arts and Lett.* 17:663–679
- PARFIN, S.I. and A.B. GURNEY (1956): The spongilla-flies, with special reference to those of the Western hemisphere (Sisyridae, Neuroptera).— *Proc. U.S. Nat. Mus.* 105 (3360):421–529
- PARODIZ, J.J. and L. HENNINGS (1956): The Neocorbicula (Mollusca, Pelecypoda) of the Parana-Uruguay basin, South America.— *Ann. Carneg. Mus.* 38:69–96
- PENNEY, J.T. and A.A. RACEK (1968): Comprehensive revision of a world-wide collection of freshwater sponges (Porifera-Spongillidae).— *U.S. Nat. Mus. Bull.* 272:1–184
- ROBACK, S.S. (1968): Insects associated with the sponge *Spongilla fragilis* in the Savannah River.— *Notulae Naturae* 412:1–10
- THOMAS, G.J. (1959): Self-fertilization and production of young in a sphaerid clam.— *Nautilus* 72(4): 131–140

VOLKMER-RIBEIRO, C. and R. DE ROSA-BARBOSA (1972): On *Acalle recurvata* (BOWERBANK, 1863) and an associated fauna of other freshwater sponges.— *Revta. bras. Biol.* 32 (3):303–317

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